tell of some contests for priority. All pure mathematics consists in the drawing out of ideas latent in admitted principles, and it is a curious fact how men will fail to draw the consequences which to another will appear irresistibly suggested by something they have themselves asserted, and consequently how near they will come to the brink of a discovery without actually making it. And controversies as to mathematical priority naturally arise because it seems so cruel to the man who has taken all the steps except the very last, that another should step in and get the credit of the discovery, when it seems to him that he himself had done all the difficult part of the work and the other only drawn an inference so simple that no credit should be given to any one for making it. If no controversy of the kind has arisen in the present case, perhaps the cause is not exclusively the indisputable character of Cayley's claims, but something is also due to the moral nature of the man. His motto has always been "esse quam videri," and I do not know any one to whom it would be more repulsive to engage in a personal contest by claiming for himself a particle of honour or of money more than was spontaneously conceded. He would be apt to take for his model the patriarch Isaac, who, when the Philistines claimed a well which he had dug, went on and dug another, and when they claimed that too, went on and dug a third.

The place of a more minute account of his mathematical discoveries may be supplied by a mention of the wide recognition which his labours have received. He was given the honorary degrees of D.C.L. Oxford, 1864, LL.D. Dublin, 1865, and was elected Fellow or Correspondent of the following Societies:—Philosophical Society, Manchester, 1859; French Institute, 1863; Royal Societies, Edinburgh and Berlin, 1865; Boston, 1866; appointed a Member of the Board of Visitors, Greenwich Observatory, 1866; Milan, 1868; St. Petersburg and Göttingen, 1871; Royal Irish Academy, 1873; Upsala, Leyden, and Rome, 1875; Hungary, 1881; Sweden, 1882. I should add that the Royal Society awarded him a Royal Medal in 1859, and last year (1882) the Copley Medal; the latter a distinction seldom conferred on a pure mathematician.

Though his principal interests are mathematical, they are far from being exclusively so. He is a good linguist, and, as was said of Moltke, there are few European languages in which he does not know how to hold his tongue. He is chairman of the Association for Promoting the Higher Education of Women. When seats in the University Council are contested, his name always appears on both the rival lists. By all who know him he is as much respected as a high-minded man as he is admired as a mathematician.

GEORGE SALMON

BENTHAM AND HOOKER'S "GENERA PLANTARUM"

Genera Plantarum ad exemplaria imprimis in herbariis Kewensibus servata definita. By G. Bentham and J. D. Hooker. 3 vols. (London, 1862-1883.)

THE completion of the "Genera Plantarum" of Messrs. Bentham and Hooker, an event long impatiently desired by all botanists, has been recently effected by the publication of the second and concluding part of the third volume. This great work has required more than five-and-twenty years of assiduous labour, during which the authors have devoted themselves to their formidable task with untiring perseverance, and with a degree of unity both in the plan and the execution of the work which would have been impossible but for their constant daily intercourse, and their relations of intimate personal friendship.

Before undertaking the publication of the "Genera" its authors had already given to the world important works which had placed them in the foremost rank as botanists, and both were familiarly acquainted with the scientific wealth accumulated in the museums and gardens at Kew. Mr. Bentham, whose botanical collections were united to those of the Royal Herbarium as long as thirty-six years ago, had already in connection with his various works and memoirs had occasion to study nearly the entire vegetable kingdom; while Sir Joseph Hooker, in addition to an equally wide range of study, had the inestimable advantage of having during his extensive travels been able to observe in the living state numerous species of many genera characteristic of the tropical and antarctic regions, and of having fixed their analytical characters by sketches and diagrams of singular elegance and accuracy.

With a rare amount of abnegation of personal feeling the authors of this work were content to let it go forth under their joint names, without in any way indicating the separate share contributed by each of them, desiring, as it would appear, that it should be regarded as the collective result of their joint labours—the product of two minds working harmoniously for a common object. Only very recently, under the pressure of urgent requests from many different quarters, Mr. Bentham consented, in a short note communicated to the Linnean Society,[1] to explain in a summary way the share contributed by each of the authors. This is of so much interest to botanists that the present writer does not hesitate to give here the substance of Mr. Bentham's note.

The *Polypetalæ*, which fill the first volume, were pretty equally divided. While Mr. Bentham was engaged on the earlier orders, Sir J. Hooker undertook the *Cruciferæ*, *Capparideæ*, and *Resedaceæ;* and to his share also fell most of the numerous families of the *Discifloræ*, while Mr. Bentham elaborated the remaining families of the *Thalamifloræ*, along with the *Lineæ*, *Humiriaceæ*, *Geraniaceæ*, and *Olacineæ*. Of the group of the *Calycifloræ* it was natural that Mr. Bentham should undertake the *Leguminosæ*, which he had already illustrated by a series of important memoirs, and to him also fell the *Myrtaceæ*, *Umbelliferæ*, and *Araliaceæ*. The remaining families of this group, including the *Rosaceæ*, *Saxifrageæ*, *Melastomaceæ*, and *Cucurbitaceæ*, besides many others less important, were assigned to Sir J. Hooker.

The first portion of the second volume is almost entirely occupied by the two great families of *Rubiaceæ* and *Compositæ*. To the former of these Sir J. Hooker devoted two years of constant study which involved very numerous dissections of a difficult nature, and he also elaborated the *Caprifoliaceæ*. During the same period Mr. Bentham was mainly occupied with the vast family of *Compositæ*, comprising nearly 800 genera, and not much fewer than 10,000 species. To assign definite generic characters to a series of forms so closely allied was an undertaking which, in spite of the previous labours of many eminent botanists, required the most careful examination of an almost overwhelming mass of materials, along with the severest critical acumen. The second portion of the second volume includes the great mass of the Gamopetalous families. At this period the pressure of official duties, and those devolving upon him as President of the Royal Society, prevented Sir J. Hooker from devoting much of his time to the laborious tasks of critical systematic botany; and to this portion of the work he contributed only the allied families of the *Vacciniaceæ*, *Ericaceæ*, and *Epacrideæ*, in addition to the *Myrsineæ*, *Primulaceæ*, and a part of the *Sapotaceæ*. On Mr. Bentham devolved all the remaining families of this vast group; and to show the prodigious amount of labour accomplished by this remarkable man, it is sufficient to say that, along with minor families, these included the *Apocyneæ*, *Asclepiadeæ*, *Gentianeæ*, *Boragineæ*, *Convolvulaceæ*, *Solaneæ*, *Scrophularineæ*, *Gesneriaceæ*, *Bignoniaceæ*, *Verbenaceæ*, and, finally, the *Labiatæ*. Some additional years might have been requisite for such an undertaking if his classical monographs on the two great families *Scrophularineæ* and *Labiatæ* had not supplied Mr. Bentham with the materials for his subsequent work.

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[1] "On the joint and separate work of the authors of Bentham and Hooker's 'Genera Plantarum.'" *Journal of the Linnean Society*—Botany, vol. xx. pp. 304-308.

The first part of the third volume is occupied by the *Monochlamydeæ* and the Gymnosperms. To this part the group of the *Curviembryeæ*, including the important families *Amarantaceæ* and *Chenopodiaceæ*, was contributed by Sir J. Hooker, who further undertook the *Nepenthaceæ*, *Cytinaceæ*, and *Balanophoreæ*. The materials for the latter were ready to hand, being for the most part contained in the remarkable monographs long since published by himself. The remaining families of *Monochlamydeæ* were elaborated by Mr. Bentham. Amongst the more important must be mentioned the *Laurineæ*, *Proteaceæ*, *Thymelæaceæ*, and *Santalaceæ*. But it was especially the great families *Euphorbiaceæ* and *Urticaceæ* which, in spite of recent monographs, demanded a vast amount of minute examination and careful revision of all existing sources of information. The Gymnosperms had originally been undertaken by Sir J. Hooker, who possesses so wide an acquaintance with these plants in the living state; but the pressure of other occupations again interfered, and this group was also executed by Mr. Bentham, doubtful questions here as well as throughout the entire work being reserved for discussion between the joint authors.

The second part of the third volume, which concludes the work, contains all the families of Monocotyledonous plants. The examination and revision of the vast store of existing materials appeared to the authors such a formidable task that, in the doubt whether they should be able to complete it, they resolved to attack in the first instance the most difficult families, Sir J. Hooker undertaking the Palms, and Mr. Bentham the *Orchideæ*. As is well known, the study of these families offers peculiar difficulties. In the former the great size of all the parts, as well as their texture, usually makes it impossible to preserve herbarium specimens available for study, and much restricts the supply of materials to be found even in the best-furnished museums. Notwithstanding his very extensive previous knowledge of this family, and the exceptional resources available at Kew, Sir J. Hooker found the task to involve a much greater expenditure of time and labour than he had anticipated, chiefly owing to the necessity for a very extensive correspondence with botanists in various parts of the world who were able to supply special information or materials not otherwise obtainable. Along with other special difficulties, the study of the vast family of the *Orchideæ* is hampered by the unsatisfactory condition of a great proportion of the specimens sent to Europe from countries whose climate makes their preparation and preservation almost unmanageable. It is not surprising that Mr. Bentham found more than a year of unbroken persistent labour no more than sufficient for this family, and that he subsequently required an equally long period in dealing with the *Gramineæ*.

In treating the remaining Monocotyledonous families, the task of the authors was in many cases lightened, though not by any means replaced, by the work of various recent monographers. Sir J. Hooker disposed of the group of *Nudifloræ* (*Aroideæ* and allied families) and that of the *Apocarpeæ*, including the *Triurideæ*, *Alismaceæ*, and *Najadeæ*. To Mr. Bentham fell the heavy task of completing the work by the examination of the numerous remaining families of Monocotyledons, among which may be specified the *Bromeliaceæ*, *Irideæ*, *Amaryllideæ*, *Liliaceæ*, *Commelynaceæ*, *Pandaneæ*, *Restiaceæ*, and *Cyperaceæ*. It is a surprising proof of exceptional mental and bodily activity that in dealing with this portion of the work, and in studying natural families where the floral parts are too often lost or obliterated in dried specimens, and therefore demand the most delicate and careful dissection, Mr. Bentham, in spite of his advanced age, revised and defined in the course of three years more than 1200 genera.

Throughout the progress of the work, as well as in determining its original plan and arrangement, every important question was decided after joint consideration and discussion. In this way the limits and characters of the larger groups, the descriptions of the natural families, their subdivision into suborders and tribes, and the arrangement of genera, were settled by mutual interchange of views. Almost invariably the work of each author was read and criticised by the other before it was sent to press, and the proofs were regularly corrected by both, so as to eliminate as far as possible any chance of divergence of opinion; and, finally, they were fortunate enough to obtain the help of a highly competent friend, the Rev. M. J. Berkeley, who undertook the revision of the Latin text with a view to secure the desirable uniformity of style and diction.

The descriptive characters of the families, or natural orders, are drawn up with the same care as those of the separate genera; they are clear, exactly comparable, and the affinities of families, as well as the exceptional and abnormal forms which they not seldom present, are specially noted. The approximate number of known species belonging to each family, as well as to each separate genus, is stated throughout the work, and the geographical distribution of each genus, as well as of the larger groups, has been recorded as fully as the present state of our knowledge makes it possible. Finally, very full references to the works in which each genus has been first described or best illustrated, with similar references to the authorities for synonyms, add further to the value of the work as a guide to the student of systematic botany.

The descriptive characters of the genera have been throughout verified or established after the previous examination of numerous specimens, and as a rule it may be said that for the purpose of this work the whole of the vast collections in the Royal Herbarium at Kew were passed in review, and especial attention given to the aberrant forms presented by many large genera. In the comparatively few cases where the authors were unable to refer to and examine specimens of a genus enumerated, they are careful to cite the author on whose authority it has been admitted. Genera that appear to the authors to have been founded on insufficient characters, or on an erroneous view of the structural facts, are in some cases reduced to the rank of subgenera or sections of the typical genus, in others simply recorded as synonyms at the conclusion of the description of the genus to which they are referred. There remains a further category of generic names given by authors who, either from ignorance of the science or incomplete materials, have failed to make it possible to identify them at the present day. These are enumerated as *Genera dubia* at the end of the synoptic table of the genera of each family. In short, it may be truly said that the authors have neglected nothing that could make their work useful and practical, as well as a complete storehouse of the present condition of our knowledge of this branch of natural science.

Of the many different points of view in which this great work may be regarded, the most interesting, perhaps, to the scientific naturalist is the consideration that we have here the results of a complete reconsideration of the whole subject of the classification of the flowering plants by two men of remarkable intellectual power, possessing an extent of knowledge and a command of materials far surpassing anything possible to the authors of preceding works of similar scope. In one or two brief sentences of a note already cited, Mr. Bentham has assigned the amply sufficient reasons which induced the authors to maintain in its main features the arrangement of the natural orders established by the elder De Candolle Every attempt to set forth in a linear series the complex relations which connect together as in a network the various groups of the vegetable kingdom is necessarily incomplete and defective. It is a fortunate circumstance that the authors of the "Genera" have added the weight of their authority to the judgment of those botanists who hold that no one of the various arrangements which have been proposed during the last half century, and more or less extensively adopted in some parts of Europe, possesses advantages which can compensate the serious practical inconvenience of having systematic works of reference arranged after a variety of discordant systems. The Candollean arrangement has therefore been deliberately maintained in this work, with a few not unimportant modifications; but in the arrangement and grouping of the genera into tribes and subtribes there has been ample space for the exercise of the highest faculties of the philosophical naturalist. It is evident throughout the work that every question as it has arisen has received fresh consideration, and in many important families the classification adopted is altogether new. It is remarkable that, even in regard to families previously elaborated by Mr. Bentham, he has not hesitated to introduce important changes suggested by further consideration and study. It is of course impossible to say that the final results of future discovery and research may not lead to further modifications in botanical classification; but for the present generation this will remain as the best result of the comprehensive survey of the whole field of our knowledge.

The number of genera described in the present work, taking into account the addenda, is 7565, while the number described by Endlicher in his "Genera Plantarum," with the supplements, is 7202. These figures give some measure of the progress of botanical discovery during the last thirty years, and at the same time some indications of the amount of labour involved in the collection and examination of the materials scattered throughout the numerous general works and monographs published during that period, and especially throughout hundreds of volumes of scientific periodicals which are now annually produced in every part of the world. The increase in the number of known genera is in truth much greater than the figures above cited would indicate, inasmuch as the tendency of Bentham and Hooker is to unite under the same generic designation plants which do not appear to present sufficient differences of structure, and they have not hesitated to suppress numerous genera that have been admitted in preceding systematic works of authority. Those who may not be disposed to acquiesce in these conclusions may easily continue to regard as genera the subgenera and sections whose distinctive characters are throughout the work subjoined to the descriptions of the respective genera.

It follows from the preceding remarks that for practical use in classing large botanical collections the present work is an indispensable guide. The present writer, who has enjoyed the advantage of daily, almost hourly, reference to its pages, feels that he is merely discharging a debt of gratitude in endeavouring to express his sense of the scientific value of a work which has become a classic from the day of its publication. A work which, at a given period, summarises the entire field of knowledge in one department of science, marks an epoch in its progress, and becomes the starting-point for further advance towards wider knowledge. Such is the work to which Mr. Bentham and Sir Joseph Hooker have devoted a full quarter of a century, and as such, notwithstanding the importance of their other works, it must remain their chief title to enduring fame. ERN. COSSON

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts, No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Red Spot upon Jupiter

THE red spot on Jupiter has really disappeared. I have observed the planet again after conjunction. The region in which